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Standardized Models for Project Management Processes to Product Design

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Abstract

Excellence in design is an important differentiating factor between competing products; establishing a key pillar for companies face up with safety the challenges ahead in global markets. The implementation of process management, in turn, has emerged as one of the tools for improving management more effective and its application to design product powering growth vectors, such as innovation and productivity.
A project level, the management model of the design process for products manufactured according to BS 7000-2: 2008 can be compared with the models predictive of project management, mainly international PMBOK ® guide and the model developed in Europe, PRINCE2. Potential similarities to be established in comparison shall take into account an integrated vision focus on all levels according to processes as initiation, planning, implementation, monitoring and controlling, and closing.

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1. Introduction

The industry is a critical component for the future of any country is the economic sector that creates more value added per unit of labor, ie the best productivity, with huge advantages over other sectors in the economy, as is

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revealed a recent study by the consulting firm PwC (2012). A key factor to enhance industrial competitiveness is to develop strategies around product design, applying the concept of excellence in all its stages and emphasizing innovation efforts.

The implementation of process management has emerged as one of the tools to improve the management more effective for all types of organizations, providing a vision and techniques which can be improved and workflow redesign to make it more efficient and adaptable to the needs of customers. In this regard, the process of product design as an important element in the differentiation between competing products needs to lean on effective tools that help to meet the demands of customers in the global competitive markets. In response to this need arises, the European regulatory paradigm on the design of products, standard BS 7000-2: 2008 (2008). That standard adopts a "process approach", providing guidance on the application of general principles and techniques for design management.

Simultaneously at the consolidation of knowledge of project management, were developed theories of production based in processes, as a synonym for quality assurance, efficiency and repeatability of results, premises which as axioms taken over by the predictive project management, Palacio and Ruata (2011). The project management processes are globally applied and to all industry groups. Good practice means there is widespread agreement as to which it has been shown that the application of project management processes increases the chances of success of a wide variety of projects.

It is advisable to make a comparative analysis of project-level management of some of the predictive models used for project management, with European regulations for managing the design of manufactured products. It will be useful to establish some kind of connection or link between the processes of project management according to PMBOK ® Guide and the differences with the model PRINCE2 and BS 7000-2: 2008 guide to design management of manufactured products. This ratio will be set by a table that includes such comparative of management at project level.

2. Management of the product design process

In technologically more advanced countries, technical productivity innovations which mark the differences between companies belonging to various economic sectors currently are related to organization of work. In this regard, the fifth innovation named "continuous process improvement", has evolved into a new integrated management approach, which is the named sixth historical innovation in improving the technical productivity "total management system by processes."

The international standard ISO 9000 defines "process" as "the set of interrelated or interacting activities which transforms inputs into outputs" (2005). In this line the requirements of ISO 9001 quality systems establish that the organization should determine the processes needed for the system of quality management and its implementation across the organization and determine the sequence and interaction of these processes (2008).

2.1. The process approach

Any activity or set of activities linked together that uses resources and controls to transform inputs (specifications, resources, information, services ...) into outcomes (other information, services ...) can be considered as a process. The results of a process must have an added value to the inputs and can be directly input to the next process, taking into account the satisfaction of customer requirements. The processes are activities that are produced continuously, or a series of known operations to be repeated whenever the circumstances require it, Nokes et al. (2007), assimilated concept "routine tasks" by Gómez García et al. (2000) and "operations" by Horine (2010).

The process approach involves the systematic identification and management of the processes taking place in the organization and in particular the interactions between such processes. ISO 9000, states that a desired result is achieved more efficiently when activities and related resources are managed as a process.

2.2. Product design

One of the most important stages of the production of a product is the design phase. This stage should be used to meet the reasonable and predictable requirements of the market at the same time it should be used effectively the available resources for design.

Abernathy and Utterback (1978) considered the newly created manufacturing processes have some freedom initially: the procedures are not set, the design of jobs and the flow of materials is informal and flexible. In abbreviated form, the process is fluid. At the other end, it was that once the process had been perfected through the accumulation of experience, jobs are standardized, the procedures are automated and established rigid specifications. Process becomes specific.

In an early design phase could be called, "concept phase" or "product conceptualization", it is often difficult to assess which is the best among alternatives. One possibility is to use the original method of Stuart Pugh, University of Strathclyde, Scotland, called "concept selection". Evaluates products against selected parameters, and is a method designed to spread innovation that replaces the arguments about which of the concepts is better. Usually a product or family of products emerging from the initial seeds of new products and get a wide acceptance in the market. These products, called "dominant designs", make it possible to increase the rate of systematization of the design process. According increasing standardization, process innovation decreases.

2.3. Standard for design management in manufactured products

The necessity of search for new opportunities to compete successfully in world markets leads to the adoption of proven standards based on the results of the experience and technological development. In this way, British Standard BS 7000-2: 2008, involves the application of principles that facilitate the creation of products for production on time, within budget, meeting the requirements of customer satisfaction and the organization.

Likewise BS 7000-2: 2008 provides guidance on the design management of all kinds of manufactured products, and deals with all phases of the process, from product concept to delivery, use and disposal. It is aimed at all levels of management in all types of organizations involved in the design.

It provides guidance on the application of the general principles and techniques for design management, raising awareness of management issues and emphasizing the need for an integrated approach to product design. The concepts, principles and quality system elements described in this standard are applicable to all kinds of products.

The above standard is broken down into the following sections:

- Section 1-General: focus on the object and management implementation within the scope of the standard.
- Section 2-Management organization level of the manufactured products design: provides ideas about what should be achieved at all levels of the organization, seeing it as a whole and especially studying the direction and guidance of those who have responsibility for design management..
- Section 3-Project level Management of manufactured products design. Overview: those activities about managing the design of manufactured products are specific to the project. The design process model for manufactured products proposed in this section will be used in the table 1.
- Section 4-Management in more detail for the design of manufactured products: of manufactured products: provides guidance to those whose main responsibility is the management of design.

3. Project management process

In most countries, leaders in the industrial sector, the importance of project management is evidenced by measuring productivity and performance evaluating both, people who lead and implement the projects and the ability of organizations to provide a suitable environment for the management by projects. These countries have national standards in project management which use companies and public administration. The project management processes are applied globally and to all kind of industry groups.

The recent study carried out by the Management of Competences Office in Project Management of the Project Management College (2012), highlighting the importance of the implementation of project management, revealing that in the companies in which it has been applied it has been noted that they improve overall business performance and they achieve cost and time efficiencies up to 50% in one or two years.

There must to distinguish between product or process oriented projects. Hay que distinguir entre proyectos orientados al producto o al proceso. Inside the product-oriented can be distinguish those are focused on to add new functional qualities to the product to make it more versatile or indirectly attempting to make them more efficient by improving cost reductions or changing processes or other activities of the organization to achieve increased efficiency. Process-oriented projects can focus on the implementation of new production processes or modification of existing ones, with the aim of reducing costs or affect the characteristics of the products.

3.1. Project management modes

Predictive Project management defines project as "unique set of activities needed to produce a predefined result in a certain date range and a specific assignment of resources." Considering that a project has been successfully developed when the intended purposes is achieved with the assigned budget and on the dates have been estimated previously.

The development of the body of knowledge of predictive project management that provides predictability and quality guarantees on results, has been collected in the following organizations:

- International Project Management Association (IPMA)
- Project Management Institute (PMI) and
- PRINCE2

The two first emerged as professional organizations to develop methodologies and processes for project management and from the beginning were intended to develop valid knowledge for any project. PRINCE2 was developed by the Central Computer and Telecommunications Agency (CCTA) of the British Government for specific projects of Information Technology, but a review in 1996 expanded its range of validity for any type of project.

PMI and PRINCE2 organizations have developed their respective descriptive guides of their project management processes, which through its updated versions gather new trends that contribute to the success of projects. These guides are highly valued by management professionals in any type of project, in general, and design manufactured products, particularly.

3.2. International Guide of project management PMBOK and the European model of project Management, PRINCE2

The project definition given by the Project Management Institute consisted of: "A temporary effort aimed at creating a product, service or result". This guide describes five process groups and five areas of knowledge and their interrelationships. The new version of the PMBOK ® highlights the expert judgment as the main tool of the processes of integration management, this trial is granted by companies, consultants or any person who can prove knowledge, expertise and experience in an application area, knowledge area , discipline, industry, and so on.

This does not mean that the knowledge, skills, and processes described should always be applied the same way in all projects. For a certain project, the project manager, in collaboration with the project team, always has the responsibility to determine which ones are the appropriate processes and the suitable degree of rigor for each process (in this aspect is identified with agile practices). It provides an overview of the project life cycle and its relationship to the product life cycle. It describes the phases of the project and their relationship with each other and with the project.

In Europe, the widely accepted PRINCE2 methodology, defines a project as "a management environment that is created with the aim of achieving one or more business products according to particular business model" or what is the same as a business case agreed. PRINCE2 offers a project management methodology that covers the management, control and organization serving for any type of project. It is based on the same principles as PMBOK ® and enlarge concepts that it presents, providing complementary techniques to reduce the risk and increase the quality of the projects more effectively.

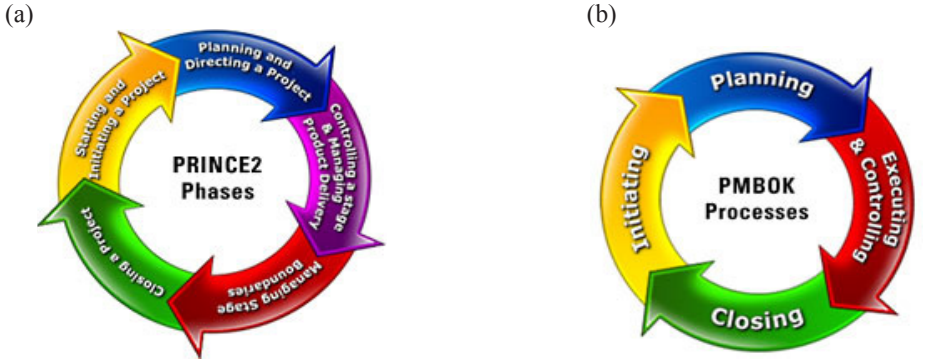

Fig. 1. (a) PRINCE2 (Projects in Controlled Environments); (b) PMBOK (Project Management Body of Knowledge).

4. Comparative analysis of project management processes for managing the design of manufactured products

At project level, the management of the design process of products manufactured according to BS 7000-2: 2008 guide to design management of manufactured products can be compared with the predictive models of project management previously analyzed, the PMBOK® Guide and PRINCE2 model. It´s outlined below the project management processes which serve to guide each of the models.

4.1. Process description

Starting with the description of project management processes reflected in the PMBOK ® Guide:

- Initiation: Project charter act, statement goal or scope of the project, identify stakeholders.
- Planning: Develop project plan, scope planning, scope definition, create WBS, activity definition, establishing sequences of activities, estimating activity durations, schedule development, cost estimates, preparation of budget costs, quality planning, human resource planning, communications plan, planning, risk management, risk identification, qualitative and quantitative analysis, response planning risks, plan purchases and acquisitions, plan contracting.
- Execution: Lead and manage project execution, perform quality assurance, acquire project team, develop project team, sharing information, managing stakeholder expectations, request responses from vendors, vendor selection.
- Monitoring and control: Monitor and control project work, integrated change control, scope verification, scope control, schedule control, cost control, perform quality control, managing the project team, performance reporting, monitoring and risk control, contract administration.
- Close: Project closure, closure of contract.

The typical system of project management for manufactured products reflected in BS 7000-2: 2008 sets out the

process description, according to the different stages of the project using the following model:

- Concept: Introduction of a new or improved product, opportunity analysis, training the individual or the core team, business concept analysis and identification and product features, project formulation, objectives and strategies, appraisal and approval of the project by organization.
- Viability: Planning, research and viability studies leading to formulation of a project proposal, refinement of features, functional specification development, development of the project settings and work program, assessment and approval of the project by the organization and commitment of resources.
- Design and Development: Meeting of a multidisciplinary team of specialists to undertake the project, design concept development, customer-product experience testing, design scheme.
- Implementation and realization: Detailed design, construction and testing of pre-production design, full design finalization ready for manufacture.
- Manufacturing stage and starting Legal responsibility: Support manufacturing design, manufacture and delivery supplies, product launch, introduction, promotion and continued customer support, sales and use, in-use performance monitoring for feedback and improved design if necessary, running product testing, complete project evaluation and identification of areas for improvement in the management of the design process for the benefit of new projects.
- Finishing: Finishing of the project, design support of definitive closure activities, formal project completion, and withdrawal of the product.

To ensure that the design is optimized, the process should be able to receive feedback at any stage and, when possible, the stages of the process should be undertaken in parallel with all affected functions involved in decision-making.

The PRINCE2 Process Model provides seven processes:

- Directing a Project: (DP) this process is for Upper Management.
- Starting Up a Project: (SU) a short process pre-project gathering the data needed to start the project.
- Initiating a Project: (IP) the process examines the rationale for the project and make the start of the project documentation including the Project Plan.
- Controlling a Stage: (CS) this process describes the daily tasks of monitoring and control that makes the Project Manager on the project is where he/she spends most of the time.
- Managing a Stage Boundary: (SB) provides a controlled way to complete a plan for the next phase.
- Managing Product Delivery: (MP) This is the process of delivering the products, is where Specialized Products that will be used by users are delivered by team members
- Closing a Project: (CP) This process confirms the delivery of products and the project manager prepares the project closure.

4.2. Comparative table

The following table shows a comparison of the three described models:

Table 1. Comparative table between project management processes according with the three models, PMBOK®, PRINCE y BS 7000-2: 2008.

PMBOK® Processes	PMBOK® v. PRINCE2 Differences	BS 7000-2: 2008 Processes
Initiation	Starting up	Concept
	Directing a project	
Planning	Starting a project	Viability
	Managing a stage boundary	Design and development

	Managing product delivery	
Execution	Controlling a stage	Implementation and realization
	Managing product delivery	
Monitoring and control	Managing a project	Manufacturing
	Controlling a stage	Starting legal responsibility
	Managing a stage boundary	
Close	Managing a stage boundary	Finishing
	Closing a project	

5. Conclusions

The PMBOK ® Guide describes uniquely project management processes that ensure that the project progresses efficiently throughout its existence, including these processes, the tools and techniques involved in the application of skills and capabilities that are described in the areas of knowledge. However that product-oriented processes are outside the scope of the guide, does not mean that should be ignored, instead the processes of project management and product-oriented processes are overlapped and interact each other throughout life of a project.

The British Standard BS 7000-2: 2008 provides a predictive methodology for project management with a high degree of similarity to the PMBOK ® Guide, with regard to the description of the project management processes, identifying both the processes that have been recognized as good practice for the majority of projects. This does not mean that the described processes should always be applied uniformly on all projects, the project manager and his team will be responsible for determining what processes are suitable and what degree of rigor appropriate for each process.

However, the PRINCE2 model facilitates a series of processes that explain what should happen and when in the project so that any project guided by this method must incorporate these processes in a way, but more importantly, is to adjust the model processes to the requirements of that particular project you are working, ie the priority for the PRINCE2 model is not process management, but management phases. A PRINCE2 project is planned, monitored and controlled phase to phase, is focused on the definition and delivery of products, in particular its quality requirements, processes diverge widely.

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